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ABSTRACT

The research described in this paper is concerned with conceptual learning in disadvantaged children. The various studies discussed were concerned with the current learning capacity of the subjects. The tasks presented consisted of inductive concept problems. Subjects were provided with various experiences and the effects of these procedures on concept learning were observed. Lower and middle class children were compared under a variety of experimental conditions. Results indicate that compared to middle class children, lower class children are deficient in both discrimination learning and concept identification. Results also indicate that lower class children are responsive to a variety of procedures. Apparently, certain conceptual deficits of lower class children can be eliminated through the provision of training in discrimination learning. Thus the deficit is not a basic deficit in the capacity to learn or abstract. With preliminary training, the child can solve these problems with the same degree of efficiency as characterized the original performance of his middle class counterpart. (KJ)

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The Role of Socioeconomic Status in Problem Solving

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The research to be described below was concerned with conceptual learning in disadvantaged children. I would like to underscore the word learning because most of the studies on social class effects in cognitive functioning have been concerned with measures of achievement, i.e., they have described what the child is able to do when he appears before the researcher, rather than what the child is then able to learn. Very little is known about the disadvantaged child's current capacity for learning except for what one chooses to infer from past accomplishments. Only scattered reports of laboratory studies of learning capacity exist in the literature. In most cases these studies have used simple tasks, like paired associate (Zigler and Kanzer, 1962) or discrimination learning problems (Spence and Segner, 1967). In many cases the performance of the lower class children on these types of tasks was indistinguishable from that of middle class children.

The studies described below were concerned with the current learning capacity of the subjects, and the problems were more complex and more abstract than paired associate or discrimination learning. The tasks presented to the subjects consisted of inductive concept problems. The general strategy used in the

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studies was to provide various experiences to the subjects and observe the effects of these procedures on concept learning scores. In this way lower and middle class children were compared under a variety of experimental conditions.

In an earlier study (Scholnick & Osler, 1969), the effect of instructions on concept learning was observed. In that study we found a significant performance gap between lower and middle class eight-year old children on a concept attainment problem. It seemed to us at the time that the poorer performance of lower class children was probably due to lesser experience with the task. In order to test for this possibility we took a second group of lower class children and let them work on an illustrative problem before presenting the concept tasks. The results of that study indicated that after working on the sample problem the performance of the lower class children was equal to the original performance of the middle class children. This finding seemed to be consistent with the idea that the original social class effect reflected the unequal prior experience of the two groups of subjects.

We then decided to investigate the effect of an illustrative problem on the performance of middle class children. The results indicated that they, too, profited from this additional experience; so that once again, if the performance of both groups were compared under the condition of elaborated instructions, the middle class children were once again superior to their lower class counterparts. The error data on this problem

are shown on Table 1.

Insert Table 1 about here

It appears, there, that while social class differences in performance were found under both conditions, the disadvantaged children who had had experience with the illustrative problem performed on a par with the original scores of the middle class group.

We were interested in these results because it seemed that a relatively simple form of intervention was sufficient to offset the original deficit of the lower class child. The question, therefore, arose as to the efficacy of other forms of intervention. As a consequence, several pretraining procedures were designed and the effects of these were studied in another experiment. It is this experiment which will constitute the essential part of the present report.

All subjects participating in these studies were white children attending kindergarten. The lower class children came from families in which the fathers worked in unskilled or at most semi-skilled occupations and had an average of nine years of schooling. There was a high rate of unemployment among them. The middle class children came from families whose fathers were business executives or worked in professional capacities. Most

of the fathers and mothers in these families were college graduates.

The present investigation was aimed at comparing learning rates of lower and middle class children under five pretraining conditions. In order to clarify the pertinence of the training conditions to the transfer task, the latter will be described first. As indicated earlier, the transfer task was a concept attainment problem. Eight geometric figures of red or blue circles and squares of two different sizes constituted the stimulus set. Transparent slides were made of each figure and the slides were projected one at a time on a small screen of an apparatus described elsewhere (Osler and Shapiro, 1964). As each stimulus appeared on the screen S was required to press one of two levers located beneath the screen. The task was to learn which attributes of the stimuli were relevant for the responses. In each problem either form or color was the relevant dimension. When color was relevant, for example, the left lever was appropriate for all blue figures, and the right lever for all red figures, regardless of the shape or size of the stimulus. In essence, the subject was required to divide the stimulus set into two subclasses according to a rule devised by the experimenter and not known initially by the subject. In fact, the essential feature of the task was for the subject to learn the rule according to which the stimulus set

was to be partitioned. Correct responses were reinforced with a marble. The procedure was continued for 160 trials or until the subject attained criterion (15 correct responses in any block of 16 consecutive trials). As indicated earlier, this was the final task in the procedure. Prior to working on this task each S was pretrained.

There were five experimental groups, differing in the type of pretraining received. While each training procedure involved discrimination learning, the problems presented to the groups differed in the kinds of stimuli to be discriminated or the amount of inference required. The conditions pertaining to each group may be examined by reference to Table 2.

Insert Table 2 about here

The purpose of the training in the S (stimulus differentiation) group was to familiarize the children with the stimulus attributes which later appeared in the concept task (circle-square, red-blue, and large-small). For example, in one training problem the stimuli consisted of a black square and a black circle. Obviously this problem was intended to familiarize the subject with the two forms which were later used in the concept problem. There were, in addition, problems in color and

size discrimination. As in the concept problem, the solution required the association of a lever with each stimulus. However, since the subjects in this group were to be merely familiarized with the attributes of the stimulus set, without being taught how to solve the problem, E showed S how to respond to each stimulus as it appeared on the screen. Following the initial help from E, the subject was required to reach criterion (nine correct responses in a block of ten trials) without further assistance.

In the I group (inferential training), the Ss were presented with discrimination learning problems which they were required to solve without assistance. The stimuli consisted of pairs of pictures of common objects, as shown in Table 2. The aim of the training in this group was to provide the Ss with experience in problem solving without familiarizing them with the attributes of the stimulus set to be used in the transfer task.

The Ss in the SI group received the combined experience of the first two groups. Here the stimuli were the same as in the S group but the Ss were required to reach solution without help from E, as in the I group. In summary, then, one group acquired familiarity with the stimulus attributes, the second with the method of solution, and the third group with both the stimulus attributes and with the method of solution.

The fourth group was a control (P). In this group the Ss first worked on the illustrative problem described in Scholnick and Osler (1969) and then proceeded directly to the concept attainment problem.

The fifth group (C) was another control. Here the Ss worked on the concept attainment task without the benefit of the illustrative problem or any other type of pretraining.

The results will be shown separately for the training problems and for the concept problem. Table 3 shows the mean errors on the training problems. An analysis of the data showed two significant effects, social class ($F = 4.80$, $df = 1/114$, $P < .05$) and type of training ($F = 7.89$, $df = 2/114$, $P < .001$). The SI type of training was clearly the most difficult. The social class effect is, of course, due to the poorer performance of the lower class children.

Insert Table 3 about here

Now for performance on the concept attainment problem. The data are shown on the Table 4. Analysis of the data showed that there was a social class effect ($F = 10.10$, $df = 1/188$, $P < .005$) and a training effect ($F = 4.99$, $df = 4/188$, $P < .001$. There was no significant interaction between the social class

and training variables.

Insert Table 4 about here

However, when separate analyses were performed within each social class, it turned out that a highly significant training effect was obtained in the lower class ($F = 5.54$, $df = 4/84$, $P < .001$), while no training effect was found in the middle class. In view of the nonsignificant interaction this result requires explanation. A closer examination of the data showed that training yielded a similar pattern of improvement in both populations, but the effects were sufficiently larger in the lower class to produce a difference in significance levels in the two populations. The data were then examined for improvement rates in the two populations. If we combine the errors of the three training groups and the two control groups within each social class, we find that the lower class children show a 24.3 mean error difference while the middle class children show a 10.9 mean error difference. Using the control data as a base, the lower class children improved 36% while the middle class children improved 24%.

To summarize the data so far, it has been shown that, compared to middle class children, lower class children are deficient in both discrimination learning and concept identification.

It has also been shown that lower class children are responsive to a variety of training procedures. The fact that they seem to be somewhat more responsive to training than middle class children indicates that the initial deficit may have its origin in inadequate prior experience.

Before attempting to specify the nature of the experiential deficit, the data may be evaluated from another perspective. Ordinarily, enrichment procedures are introduced in an attempt to bring the performance of disadvantaged populations closer to the middle class level. To evaluate the training effects in this context, the scores of the trained lower class children should be compared with the <u>original</u> scores of the middle class children. Such a comparison shows the mean errors for the lower class to be 42.8 and for the middle class 45.5.[2] It is quite clear from this comparison that after training the social class effect disappeared. This result is completely analogous to the one reported earlier (Osler and Scholnick, 1969).

It seems quite apparent, then, that certain conceptual deficits of lower class children (those reflected in the types of problems used in the present study) can be eliminated through the provision of training in discrimination learning. On this basis it may be concluded that the cognitive impairment of the disadvantaged child is not profound, as it does not involve basic deficits in the capacity to learn or abstract.

Now let us turn to a comparison of the relative effectiveness of the treatments. Analysis of the data revealed that there was no reliable difference between the three trained groups, S, I, and SI, nor between the two control groups, P and C. The fact that the several types of training were equally effective in reducing errors is open to at least two interpretations: (1) that the common features of the training procedures were responsible for the improvement (and retrospectively it appears that the treatments had more in common than was originally intended); and (2) that the function of the training was not to supply a specific skill but rather to supply the subjects with a vehicle for learning to learn. On the basis of additional data it appears that the S condition provided more training than intended mainly because Ss were required to attain criterion performance on their own. All three conditions therefore involved the solution of discrimination learning problems, and this common feature of the training apparently obscured the effects of the other aspects of the training procedures.[3] More recent work shows that where Ss are familiarized with the stimulus attributes without participating (even as observers) in the solution of a discrimination problem, their performance is significantly poorer than the performance of those Ss working under the I or SI condition (Osler, 1970).

So far as social class effects are concerned, the results imply that the lower class child requires preliminary practice in order to solve complex problems. But once he has the preliminary training, he solves these problems with the same degree of efficiency as characterized the original performance of his middle class counterpart.

Some cautions should be exercised in interpreting the data. The discussion so far has been concerned with performance in the laboratory. Generalization of these findings to schoolroom learning poses additional problems. For one thing, the child's motivation in the laboratory is high. He works individually with an experimenter, receives immediate reinforcement, and works on a novel task. More variability in motivation inevitably occurs in the classroom.

Additional questions concerning these results must be asked: (1) How lasting are the effects; what will happen to the relative performance of the two populations a month or two or a year later? and (2) To what extent are these improvements generalizable to the solution of other types of problems, conceptual or otherwise. Only additional investigations will provide information on these issues.

If these transfer effects turn out to be stable, it will be interesting to speculate on other methods of training to optimize the performance of both populations. Whether optimum performance

implies the total elimination of deficits, even when both populations are equally pretrained, cannot be asserted at this time. What can be asserted, however, is that the deficits in concept learning exhibited by lower class children in the laboratory can be offset by a relatively small amount or pretraining.

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Footnotes

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[2] The 42.8 figure represents the mean of the three pretrained lower-class groups, while the 45.5 figure represents the mean of the two nonpretrained middle-class groups.

[3] In a previous paper reporting on the effects of similar pretraining procedures on concept identification (Osler and Scholnick, 1968) it was reported that the SI condition resulted in greater positive transfer than was the case with the S or I condition, a finding which is not consistent with the present report. A reexamination of the procedure used in the former paper revealed an unfortunate oversight which is undoubtedly responsible for the superior performance of the SI group. Reference to Table 3 of the Osler and Scholnick paper reveals that in the pretraining condition for size discrimination the stimuli were the same as were subsequently used in the concept problem. From Table 4 of that paper it is apparent that it was

the exceedingly low score of the group working on the identification of the size concept which was responsible for the overall superiority of the SI group. In the present investigation this error was not repeated.

Table 1

Mean Errors per Group

Group	Mean Errors[a]
Lower-class--Control	64.8
Lower-class-Pretrained	50.7
Middle-class--Control	56.0
Middle-class--Pretrained	42.0

[a]Error scores for individual subjects consisted of errors to the criterion run of 30 correct responses in a block of 32 trials. For Ss who did not attain criterion errors within 160 trials were computed.

Table 2

Stimuli Used in Pretraining

Group	
S and SI	I
black circle and black square	pumpkin and flower
red triangle and blue triangle	coat and clock
large orange star and small orange star	dog and wagon

Table 3

Mean Errors in Discrimination Learning

Group	Type of Pretraining		
	S	I	SI
Lower-class	1.7[a]	3.4	5.7
Middle-class	0.8	1.8	3.6

[a]Each figure is the mean of three scores obtained on each of 20 Ss.

Table 4

Mean Errors in Concept Attainment

Social	Condition					
Class	S	I	SI	P	C	Mean
Lower	47.6	32.2	48.7	66.4	67.7	52.5
Middle	35.4	32.5	36.0	40.4	50.6	39.0